Business Applications:-

1. **Resource Sharing** - Software for communication & hardware like printer.

2. **High Reliability** - Having alternate solutions for one problem.

3. **Saving Money** - Not all systems have each reasource.

4. **Communication Media** - Voice Over IP (VOIP) making telephone calls, desktop sharing

5. **Scalability** - When the increase of workload we add one more system.

6. **E-commerce** - Online shopping.

Advantages for Home applications /

1. Access to remote information (magzines)
2. Person to person. (mail, facebook)
3. Interactive Entertainment (Games, quiz, movies, music)
4. Ubiquotous Computing (security alarams, meters, smoke detectors)
5. E-commerce - (amazon, meesho, etc).

Mobile (uses of CN)

1. Difference b/w wireless network and mobile computing.

→ In militaries
→ Transport like OLA, Uber
→ like food delivary - Swiggy, zomato.
→ Hotspots, GPS.

Social Issues:-

1. Network neutrality - No network restrictions (bits transmission normal flow)
2. Content Ownership - Copyright, pyoasy
3. Privacy - Unknown links, cookies, web tracking.
4. Theft - Phishing, botnets (set of compromise machine)

Network Hardware :- (CN)

```
          Transmission    Scale
```

```
     PPP            Broadcast
```

PPP
1. Many connections
2. packets transmission
3. Source to destination

unicast - 1 to 1

multicast - 1 to many

Broodcast - 1 to all

Broadcast → one is shared by all machines in network

1. Packets consists IP addresses.

Anycast - Sending the data to the any nearest one.

Based on scale

1. PAN	2. LAN	3. MAN	4. WAN	5. internet

1. PAN ↓
1-10 meters
wireless -
Bluetooth,
hotspots
Wired -
firewires

2. LAN ↓
10 - 100 meters
Room, building
wired - switch;
more speed than
router, cables
wireless - wifi
(speed 450-600
megabits / sec)
802.11
static - roundrobin
Dynamic -on demand

3. MAN ↓
Connect city
amplifier-
to strengthen
the weak signals
Wired - 802.16

cover country/
continent.
Wired Wans
subnet -
┌ connecting
│ all the hosts
└→ transmission
    lines - transmit
    bit of info
    switching ele-
    decides the
    route from
    source -dest.

4. WAN

5. internet ↓
Covers whole
planet,
Gateways
translator

23/8/22   **Network Software**

→ Protocol Hierarchies
→ Design issues for the layers
→ Connection oriented vs connection less.
→

Protocol Header

Host 1, Layer 5 Protocol, Host 2
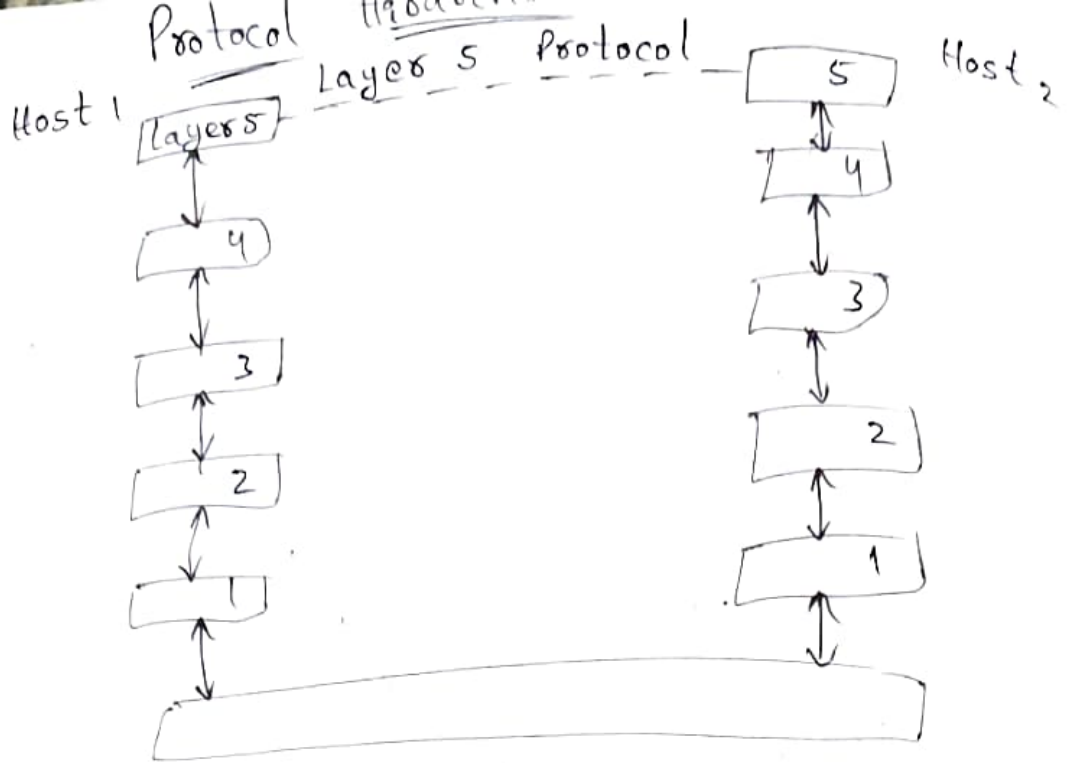
* Each and every layer can contain an ✓ entity or peer.
* The entity is nothing but human / system.
* There is an interface b/w the layers, it means what type of operations can perform.
* The set of layers & protocols is called network architecture.
* set of protocols is called "Protocol Stack".

Layer-4 Does not impose any restrictions on size of packet.

Layer-3 It restricts the size so the message will be divided & chooses best path.

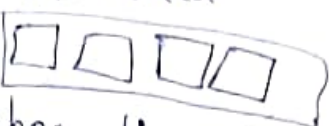Layer-2 Adds trailer info along with header info

Design issues of the layers

1. **Reliability** - Data passage will not be stopped under any circumstances.

2. **Error detection & correction** - error control will be done.

3. **Routing** - Data has been delivered through efficient path.

4. **Naming & Addressing** - Added systems will be given some name.

5. **Internetworking** - Reassembling of packets by using sequence numbers.

6. **Scalable** - Adding more system.
   IPV4 (2^{32}) IPV6 (2^{128}).

7. **Multiplexing & de-multiplexing** - data comes from multiple centers will be transmitted to destination by combining them & vice versa.

8. **Flow control** - Speed of sender and receiver.

9. **Confidentiality, Authentication & Integrity**
   - Privacy, without modification of data Authorised persons.

Connection oriented service and connectionless service

connection-less - transfers the data.
packets 4 2 1 3 □ □ □ /□

Reliability - packet reaches the destination

Connection oriented - msg stream byte stream.

If I send 1000 bytes
Total msg was displayed   No msg boundary was
preserved.

unreliable - packet may or may not reached.

Connectionless unreliable datagram :- Telegram.
Acknowledged datagram - Register post, whatsapp.
Request reply - client server architeture.

Connection oriented -
Service primitives - Operations that are
available to user
                    to perform

1. Listen (server exchute when it is free)
2. connect (client has to connect, IP, request)
3. Accept (server accepts the request)
4. receive (server executes this then blocked)
5. send   (data was transferred)
6. disconnect (closes the connection)

OSI Reference Model.

→ Network architecture (base for all)
① OSI   ② ICP

1. Open System Interconnection   (ISO)
* open interconnection with other system.
. * 7 layers with different abstractions
* Each layer has well-defined function.
* follow ISO standards.
* info flow
* layers no. optimum

Diagram:
→ Each layer has its own protocols.
→ Top most Application, — doesnot specify
any function just tell about each layer.
Application — Gmail (browser) holds SMTP, HTTP, FTP

Presentation

Translation, ASCII → EBCDIC   loosy
                                loosely.
compression, encryption. received data
from application layer, deals with
syntax, semantics.

Session layer: (establish logical connection)
→ APIS, NETBIOS
Authentication, authorization, data packets.
session management.

same time dialogue
sending data
             & synchronization [checkpoint]

Transport layer:-

segmentation

flow control - sender, receiver, buffer

Error control

Connection oriented & less.

Network layer

segments called as packets & IP address is added, path determination routing

    inbuilt routers   shortest path.

Handling congestion (too much traffic in the network)

Datalink layer:- (local Area Network)

packets called as frame - Mac address (Medium Access Control) physical address, flow control, error control

Note - Top 4 layers

Physical layer

Frames to bits "0101" signals through cables and setellites.

Tail   → reassembled.

Header - checksum, IP, MAC

Next lab task

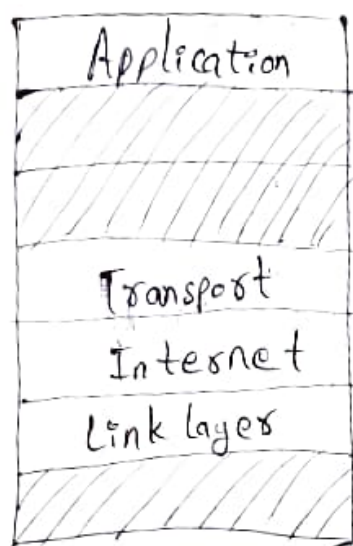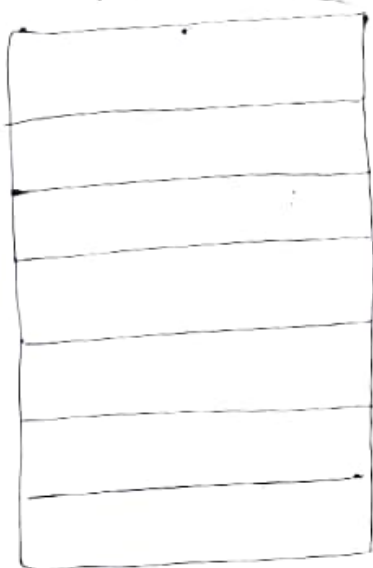→ Study of various topologies.

Today lab

Java program to find ip address of
local host
Java program to find the ip address
of network host
Java program to find mac address of
local host.

8/9/22 TCP/IP

→ 4 layers, most used nowadays.
→ Link layer - not a layer

→ Internet - key layer which holds the
whole architecture, allows ports
to   packets routing (IP, ICMP)

Transport - Similar to that of OSI
provides two types services
connection oriented-TCP (byte stream) message
connection less - UDP

Application - User can communicate, combination
of present & session layer operations
are similar.

Comparission b/w OSI & TCP

Similarities
→ Both model work on protocol stack.
→ Functionality is roughly similar
→ Layer above network layer have
   end-to-end communication.

Dissimilarities :-
→ Service -
→ Interface - how the above layer
→ Protocols - About rules & regulations.

TCP - does not specify about these
      three
②

③ In protocol after model
④ network layer only connection-less.

Network Core :-

Circuit-Switching - Resources needed for the communication preserve in advance.

Packet Switching- Resources are preserved on demand.

Restuarant :- order, waiting

packets use full strength of transmission lines to go to destination.

Suffers -

Store & Forward Transmission :-
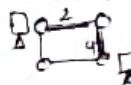Router waits utill all packets are reached.

N - No. of links , $N-1$ routers.

Queuing Delays & Packet loss :
for waiting Router has buffer (finite)
→ forwarding table (Des Addres - line)
(special routing algorithms)

Circuit Switching :- Ex:- Connection is also called circuit.

Connection

FDM (radio fm) frequency
TDM ( ) time   frame has 4 circa,

Unit-II

How it is structured - Application architecture

Google has 30-50 data centers

Each one consists of more hosts (100's)

ISP pay money to use the services to the data centers.

> peer- An active entity which is present in all layers to communicate with.
> Both server & client - From my system
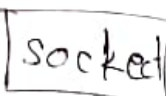>
> otherone requested

↳ Challenges:

Security

ISP user friendly (upstream maintain) intensives - complaint.

Hybrid - IP address

Application

process ⟶ House

socket ⟶ Door

Transport process

Through the cable next layers receive

Transport layes assign port num.

software (run the program)
Application A&c
Communicate (socket)
How msgs are exchanged ⤹

20/9/22

-- HTTP is heart of web. It defines how
the client and server interact with
each other.

URL ──→ hostname, path name
    Ex:- www.vrsec.ac.in / IT timetable.

──→ HTTP· will establish the TCP connection
b/w client & server.

* Once connection is established.
* Through sockets the msg exchanged.
* TCP Controls the msg after comes
from client.
* Server can't store any state info of
the client, any times requested the
response will come.

Once the object completes works the
connection will be closed (same TCP)
diff.

By default HTTP provides 5-10 parallel
connections.

Round Trip Time - Whenever user clicks
the link HTTP establish TCP connection
server acknowledge (1RTT) (2 way handshaking)
(2 RTT's) are required fsending req backto server
→ same server objects will send to the
client then the connection wil
→ The process of sending msgs without
waiting for the acknowledgement.

20/9/22 HTTP request message :-

request line - method sp URL sp version cr lf
cr - carriage return (
lf - line-feed
Entity body is empty with get.
post - user submit the button of form.
put - to upload something in the server
head - It can't send the obg to the request
delete -   ed-

Response message :
status line - version status code phrase

22/9/22 web catches (proxy server) [own storage]

→ Network entity that satisfy users
request will be reached proxy (stores copy)

→ If there is no content establishes the
TCP connection.

→ proxy will act as both client & server.

24/9/22

Cookies :—

27/9/22 FTP :—

→ To upload or to download a file
user agent. (TCP connection establish)

→ Uses 2 parallel connections

i) Control - Authentication
2) data - for sending file

Email (SMTP)
1) User agent - composed mails read, reply, save, forward
2) Server agent -
3) SMTP

DNS (Domain Name System)

→ Host names can't be determine by router. (Not understand names) Ipaddress

→ Hierarchal DB, distributed DB which is in DNS server (convert the hostname in ipaddress) Application layer Protocol.

→ client side construct a query.

Host aliasing
Entire name of host will not be given.

mail server aliasing
Not giving the entire name of website or application.

Load destribution:-
Eevery E-commerce application has diff. server distributed to everyone by using FCFS Ipaddress.

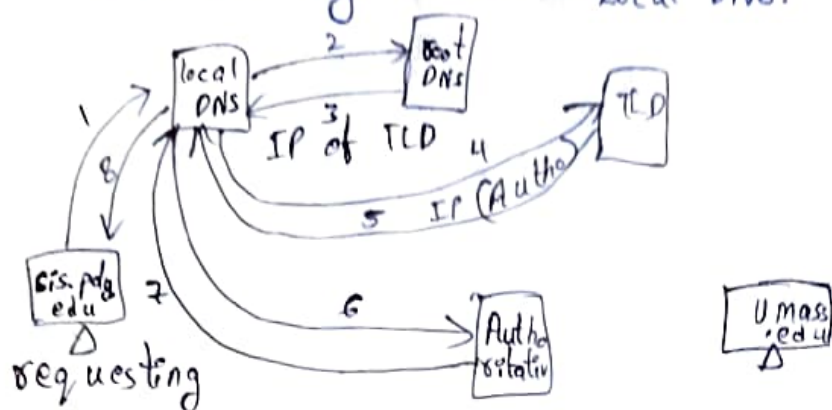→ centralized — disadvantages: load, traffic
→ Distributed. —

root, DNS server
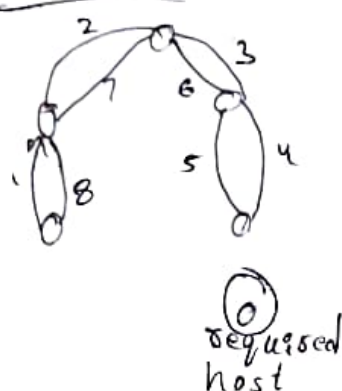↳ Authoritative - where all the records are stored related to amazon.
high level

* 13 root servers accross the world.

Local DNS:-

→ Maintained by ISP → Local DNS.

requesting

recursive :-

requised
host

11/10/22 Transport layer

→ providing end-to-end transmission to process-to-process transmission.

UDP → Provides 2 services
  ① Multiplexing
  ② Integrity

TCP → Provides the services other than
establish these 2 services.
→ It was followed by DNS.

TCP - 20
UDP - 8 bytes to store header info.

UDP checksum

* Sender puts checksum value
* receiver checks if it is erroneous or not

2-16 bits data will be added

```
1011011001010110
0111001100101010
```
_____

13/10/22 **TCP :-**
→ Connection oriented
→ full duplex communication
→ Multicasting is not possible, point-to-point
→ client socket.connect(server name, server port)
           ↓
     door b/w 2 layers
→ Max segment size is decided by link layer (limited)
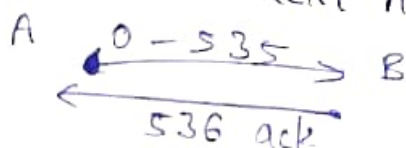   Max Transmission U - 1500 bytes
   1500-40 = 1460 segment size
→ When it comes to network layer & IP it adds 20, 20 bytes total 40.

5,00000 — Each one 1000 total 500

Seq num is 1st byte of the segment size
1000 bytes
0-999, 1000-1999, 2000-2999

Ack num - next num of last byte
A   0-535 → B
    ←
    536 ack

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